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FLAME TREATING OF WOOD IN A SURFACE REMOVAL PROCESS FOR RADIOLOGICAL DECONTAMINATION

Research and Development Technical Report USNRDL-TR-150

NS 086-001

14 January 1957

by

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Military Applications

Technical Objective
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ABSTRACT

Flame treating in combination with wire brushing was tested on pine, fir, oak, and teak. The ease of decontamination was a function of the depth of penetration. Of the woods tested, pine was the most difficult to decontaminate. Flame treating and wire brushing removed approximately 0.050 in. per pass from pine and 0.025 per pass from oak, teak, and fir.

SUMMARY

The Problem

The purpose of these tests was to determine how many burning and brushing cycles were necessary to decontaminate four woods (white pine, oak, teak, and fir) contaminated with an ionic radioactive contaminant. It was also desired to determine the relative decontamination effectiveness of with-grain and cross-grain wire brushing.

Findings

Pine, the softest wood tested, absorbed more ionic contaminant than the harder or more dense woods and the contaminant penetrated to a greater depth. Ease of decontaminating bare wood was a function of the depth of penetration of the contaminant. Of the woods tested, pine was the most difficult to decontaminate.

Flame treating and wire brushing removed approximately 0.050 in. per pass from pine and 0.025 in. per pass from oak, teak, and fir under the conditions of the test. The effectiveness of wire brushing with-grain vs cross-grain varied with the type of wood.

ADMINISTRATIVE INFORMATION

This work was carried out during the period January to November 1951 under the Sponsorship of Bureau of Ships, Project No. NS 086-001 Subtask 1.4, Technical Objective AW-5c as described in DD Form 613, dated 1 May 1952.

1. Introduction

During the development work on the Flaminator* it was found that flame treating alone removed very little contamination from a surface but that wire brushing after the burning removed a very large percentage of the contamination. It was also observed that pre-drying wood samples increased their contaminability and that a dip method of contaminating was the most satisfactory way for rapid and reproducible contamination of wood samples in the laboratory.

The purpose of the present tests was to continue, in more detail, the development of surface removal methods for wood. The main objective was to determine how many burning and brushing cycles were necessary to decontaminate four woods (white pine, oak, teak, and fir) contaminated with an ionic radioactive contaminant. In addition, a correlation of this information with the amount of surface removed (reduction in thickness of sample) and the accompanying weight loss was sought. It was also desired to determine the relative decontamination effectiveness of with-grain and cross-grain wire brushing.

2. Experimental Details

This experimental work was carried out during the period March through December 1952.

2.1 Sample Preparation

In the series of tests 24 samples were used, 6 each made of pine, oak, teak and fir. The samples were made of clear select wood, and finished smooth to a size of 1-5/8 in. by 3-5/8 in. by 12 in. Half of the samples were cut with the grain running the length of the sample (with-grain) and half were cut or assembled

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* Heiskell, R.H., and Sorry, R.C. Development of the Flaminator. U.S. Naval Radiological Defense Laboratory Technical Report USNRDL-TR-151, 15 January 1957.

from glued sections with the grain running the width of the sample (cross-grain). Just prior to contamination, each sample was oven-dried for 4 hr at 150°F.

2.2 Sample Contamination

Each sample was contaminated by the dip method. After their removal from the drying oven, the wood samples were placed face down in a tray of contaminated sea water for 30 sec. The contaminated sea water was about 1/8 in. deep. The samples were agitated slightly in the tray to obtain good distribution of the contaminant. After a 30-sec soak period, each sample was removed from the tray, turned face up, and allowed to drain at a slight angle (about 20°) for 30 sec. It was then placed in the spray booth drier for 15 to 30 min or until there was no visible sign of moisture on the surface. Drying was accomplished with the samples horizontal, the contaminated surface up.

The contaminant solution was prepared from an aqueous solution of Y^{91}, a strong beta emitter, mixed in 250 ml of typical San Francisco Bay sea water, so that the resulting activity level was 3 to 4 mC/ml. The contaminant solution was 70°F when applied to the wood samples.

2.3 Sample Counting

After contamination, and before and after every decontaminating pass, the samples were monitored with an NRDL rate meter-scaler having a 12 in. by 12 in. proportional gas flow probe. A 2-in. spacer was placed under the probe so that a surface-to-window distance of 1/2 in. was maintained. Each of the samples, the standard, and background were counted three times. Since radioautographs disclosed that contamination was deposited on the sides of the blocks and that its activity contributed greatly to the counting rate of the decontaminated sample, a 12 in. by 12 in., 12-gage steel mask with a 3 in. by 11-1/4 in. opening was placed over each block after the last decontamination, and a recount made.

2.4 Radioautography

After contamination and also after every decontaminating pass, each sample was radioautographed. Each group of three samples (such as the with-grain pine samples) were placed face down on a sheet of 14 in. by 17 in. X-ray film.* The exposure was calculated from the activity level of the samples and the time varied from 1 hr for freshly contaminated samples to 72 hr for decontaminated samples. The radioautographs were consulted frequently to determine the progress of decontamination and the contamination distribution.

2.5 Surface Removal Measurements

Before and after each decontamination, the sample thickness was measured with the same apparatus used in Flaminator tests.** This apparatus consisted of a surface plate, and a surface gage to which was attached a dial indicator. Each sample was moved across the surface plate with the dial indicator point resting on the contami-

* Blue Brand supplied by Eastman Kodak Co., Rochester, N.Y.

** See footnote on Page 1.

nated surface of the sample. An average of the high and low readings (hills and valleys) was used as the thickness of the sample. Both with-grain and cross-grain readings were taken.

2.6 Weight Measurements

Before and after each operation, each sample was weighed on a laboratory balance to the nearest tenth of a gram. It was hoped that a correlation of surface removal to weight reduction might be determined as well as moisture loss or gain effects.

2.7 Decontamination Processes

After each sample had been contaminated, counted, radioautographed, recounted, weighed, and measured for thickness, each sample surface was burned and then was brushed with the laboratory scale Flaminator (Fig. 1). For these tests the burning and brushing operations were

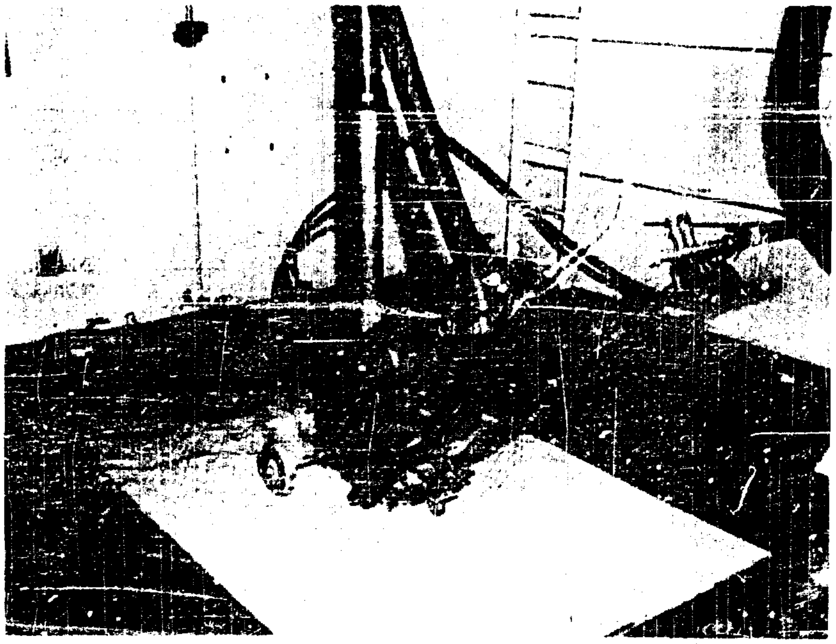

Fig. 1 Arrangement for burning and brushing the wood samples.

done separately. The samples were placed in a special jig in a floor well, so that the surface of the sample was flush with the surrounding floor. The Flaminator was then towed over the sample at the rate of 9 ft/min. The gas rates were 0.34 cfm propane, 1.05 cfm oxygen. A 3 to 3.5 burn resulted on the sample surface. These numbers refer to the arbitrary system devised in the Flaminator tests* to indicate the degree of wood charring by a 4-in. oxy-propane descaling nozzle. The charring was described as follows:

Value 1:	Slight charring directly under the flame cones.
Value 2:	Heavy charring directly under the flame cones.
Value 3:	Burning spread beyond the flame paths to give a uniform heavy char over entire surface.
Value 4:	Extra heavy char over entire surface and combustion sustained a few seconds after removal of flame.

After burning, the samples were wire brushed with the Flaminator until all of the charred wood was removed. Some of the cross-grain samples became warped so that many of the low spots were missed during the first pass. For them, one to three additional brushing passes were required to remove all of the charred material depending on the degree of warpage or roughness. The wire brush was a solid fill type, 4 in. in diameter with a wire size of 0.014 in., and was operated at approximately 1500 rpm.

The decontamination cycle was repeated twice for the oak, teak, and fir samples, and three times for the pine.

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* See footnote on Page 1

3. Results and Discussion

3.1 Counting Data

The counting data presented in Table 1 are listed without further correction than subtracting background. It was felt that this practice was justified, since the same contaminant was used on each sample, and that only relative numbers (decontamination factors) were desired. Average decontamination factors, weight loss, and amount of surface removed are presented in Table 2. It is evident that the counting rate for the "after contaminated" condition is quite uniform for a given type of wood and sample orientation. The most highly contaminated samples were the pine, with the cross-grain samples picking up 125 per cent more than the with-grain samples. This was probably caused by the end grain absorption at the edges of the cross-grain samples. The edges of the remaining samples were coated with paraffin, so there was no significant difference between the contaminability of with-grain and cross-grain samples.

Wide variations in the per cent of the contamination remaining after each pass were noted. These variations can be explained by referring to the radioautographs, the surface removal and weight loss data.

The use of the steel mask to reduce or eliminate the edge effect contamination produced much better counting results. In several cases (622 - 35 Tw and 622 - 36 Tx) the per cent remaining dropped from 13.3 to 0.369 and 4.04 to 0.121 (a 30-fold reduction). In other cases, the

Table 1 Counting Data

Samples[b]	After Contamination	Counts[a] (c/m x 10⁴) After 1st Decontamination Count	D.F.[c]	After 2nd Decontamination Count	D.F.	After 3rd Decontamination Count	D.F.
622-21 Fw	395.1	108.0	3.66	71.33	5.53	46.34	8.55
22	374.4	45.00	8.34	20.25	18.5	13.04	[illegible]
23	392.9	44.19	8.93	26.95	14.6	13.84	[illegible]
Av. Fw			6.98		12.9		[illegible]
24 Fx	468.0	143.7	3.26	94.18	4.97	26.80	[illegible]
25	457.7	140.5	3.26	59.60	7.68	27.36	16.7
26	476.4	126.9	3.76	22.99	20.7	15.73	28.5
Av. Fx			3.43		11.1		20.9
27 Ow	224.6	14.71	15.3	7.507	30.0		
28	238.7	36.07	6.62	21.04	11.4		
29	209.0	25.87	8.06	9.37	22.3		
Av. Ow			10.0		21.2		
30 Ox	210.4	13.36	15.2	4.787	44.1		
31	212.3	8.180	26.0	4.008	53.0		
32	200.3	25.39	7.87	10.04	20.0		
Av. Ox			16.4		39.0		
33 Tw	210.8	18.42	11.4	11.47	18.4		
34	220.7	31.90	6.90	20.28	10.9		
35	220.5	29.77	7.41	27.15	8.13		
Av. Tw			8.57		12.5		
36 Tx	226.0	16.14	14.0	9.126	24.8		
37	243.2	18.88	12.9	4.921	49.5		
38	245.6	8.610	28.5	2.902	85.0		
Av. Tx			18.5		53.1		
39 Fw	246.3	35.46	6.95	26.61	9.26		
40	234.4	39.24	6.00	25.39	9.26		
41	230.0	41.44	5.56	28.13	8.20		
Av. Fw			6.17		8.90		
622-42 Fx	225.7	35.02	6.45	24.69	9.17		
43	222.9	12.56	17.8	5.428	41.0		
44	232.6	13.27	17.5	5.878	39.5		
Av. Fx			13.9		30.0		

(a) Background has been subtracted from all counting data.

(b) Letter w or x after the initial designating the woods identified respectively the with-grain and cross-grain samples.

(c) D.F. = decontamination factor = reciprocal of per cent contamination remaining.

Table 2 Average Counting[a], Weight Loss, and Surface Removal Data

Samples[b]	After 1st Decontamination			After 2nd Decontamination				After 3rd Decontamination			
	D.F.[c]	Weight Loss (g)	Surface Removed (in.)	Total D.F. Uncorrected	Total D.F. Corrected[d]	Total Weight Loss (g)	Total Surface Removal (in)	Total D.F. Uncorrected	Total D.F. Corrected	Total Weight Loss (g)	Total Surface Removed (in.)
Pine w	6.98	11.4	.036	12.9		28.7	.106	21.9	103	37.8	.145
Pine x	3.43	14.1	.063	11.1		31.3	.118	20.9	23.9	43.8	.150
Oak w	10.0	11.2	.013	21.2	88.1	27.2	.036				
Oak x	16.4	8.9	.011	39.0	67.4	22.5	.048				
Teak w	8.57	14.6	.031	12.5	143	24.8	.052				
Teak x	18.5	9.4	.023	53.1	542	21.0	.048				
Fir w	6.17	6.4	.025	8.90	107	20.5	.059				
Fir x	13.9	0.8	.031	30.0	158	8.9	.043				
Av.W-grain	7.93	10.9	.026	14.2	113[e]	24.2[e]	.049[e]	21.9	103	37.8	.145
Av.X-grain	13.1	8.3	.032	40.7	255[e]	17.5[e]	.046[e]	20.9	23.9	43.8	.150

(a) Average of three samples

(b) w = with-grain x = cross-grain

(c) D.F. = decontamination factor = reciprocal of per cent contamination remaining

(d) Corrected for edge contamination

(e) Pine not included in these values

reduction was only 2-fold; the radioautograph for Sample 622-33 Tv showed that a large crack on the face of the sample still contained a sufficient amount of contamination to maintain the counting rate even though the remainder of the sample face was completely decontaminated. The average per cent contamination remaining after the last pass was 6.0, and after recounting with the edge mask, it dropped to 1.76 per cent (a 3.4-fold reduction). Table 3 lists a column of "edge correction factors" which were obtained by dividing the count without the edge mask in place by the count with it in place. These correction factors range from 0.030 to 0.947. The values for contamination remaining were multiplied by the corresponding edge correction factors to obtain the final per cent contamination remaining.

3.2 Radioautography

The most helpful supplementary information collected in this series of experiments was the radioautographs made after the samples were contaminated and after each decontamination pass. Representative sections of these radioautographs are shown in Figs. 2 through 5. After the first pass, the edge contamination became very apparent, and after the last decontamination, many of the samples showed that all the remaining contamination was around the edges. If the radioautographs had not been made, this edge effect could have been overlooked. Likewise, the radioautographs explained the reason for a relative high counting rate of individual samples in any one group; thus Fig. 2 shows that the

Table 3 Decontamination Factors Corrected for Edge Effects

Sample(b)	After Decontamination Without Mask(c)	After Decontamination With Mask(d)	Counts(a) ($c/m \times 10^3$) Correction Factor(e)	Corrected D. F.(f) for 3rd Decontamination in Table 1
622-21 Pw	510.5	285.4	1.79	15.3
22	[illegible]	41.11	3.92	112.0
23	111.3	17.31	6.42	182.0
Av. Pw				103.0
24 Px	263.7	232.5	1.13	19.8
25	262.4	200.1	1.31	21.9
26	156.8	148.5	1.06	30.1
Av. Px				23.9
27 Ow	75.78	7.75	6.25	189.0
28	196.1	94.61	2.08	23.5
29	85.2	36.70	2.32	51.8
Av. Ow				88.1
30 Ox	51.14	31.60	1.62	71.5
31	38.58	22.40	1.72	91.7
32	111.8	57.3	1.95	38.0
Av. Ox				67.4
33 Tw	117.7	[illegible]	[illegible]	33.4
34	212.8	18.60	11.5	127.0
35	240.5	7.23	33.4	270.0
Av. Tw				143.0
36 Tx	75.48	2.29	33.4	834.0
37	89.48	35.51	2.52	125.0
38	29.28	3.69	7.94	667.0
Av. Tx				542.0
39 Fw	248.6	17.74	14.1	130.0
40	236.7	23.13	10.2	94.4
41	262.6	22.23	11.8	96.2
Av. Fw				107.0
42 Fx	220.9	14.05	15.6	145.0
43	52.18	10.05	5.19	213.0
44	58.76	20.23	29.1	115.0
Av. Fx				158.0

(a) Background has been subtracted from all values.
(b) Letter w or x after the initials designating the woods identifies respectively the with-grain and cross-grain samples.
(c) Decay prevents agreement of these values with those in Table 1.
(d) Mask decreased the area by 22.4 per cent.
(e) Correction factor = Column 1/Column 2.
(f) D. F. = Decontamination factor = reciprocal of per cent contamination remaining.

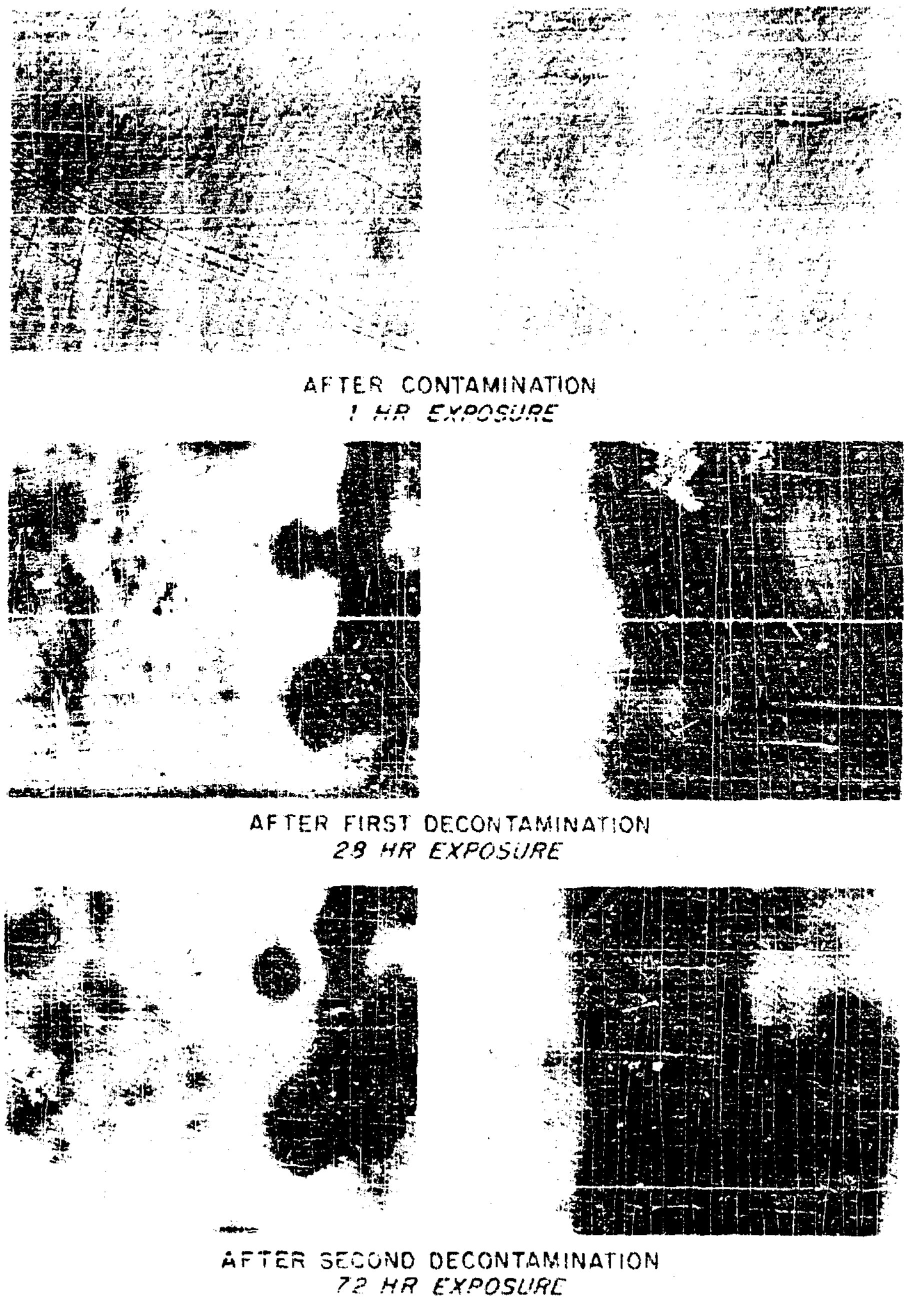

Fig. 2 Radioautographs of Representative Pine Samples; Right Column, With-Grain Sample 622-21 and Left Column Cross-Grain Sample 622-24

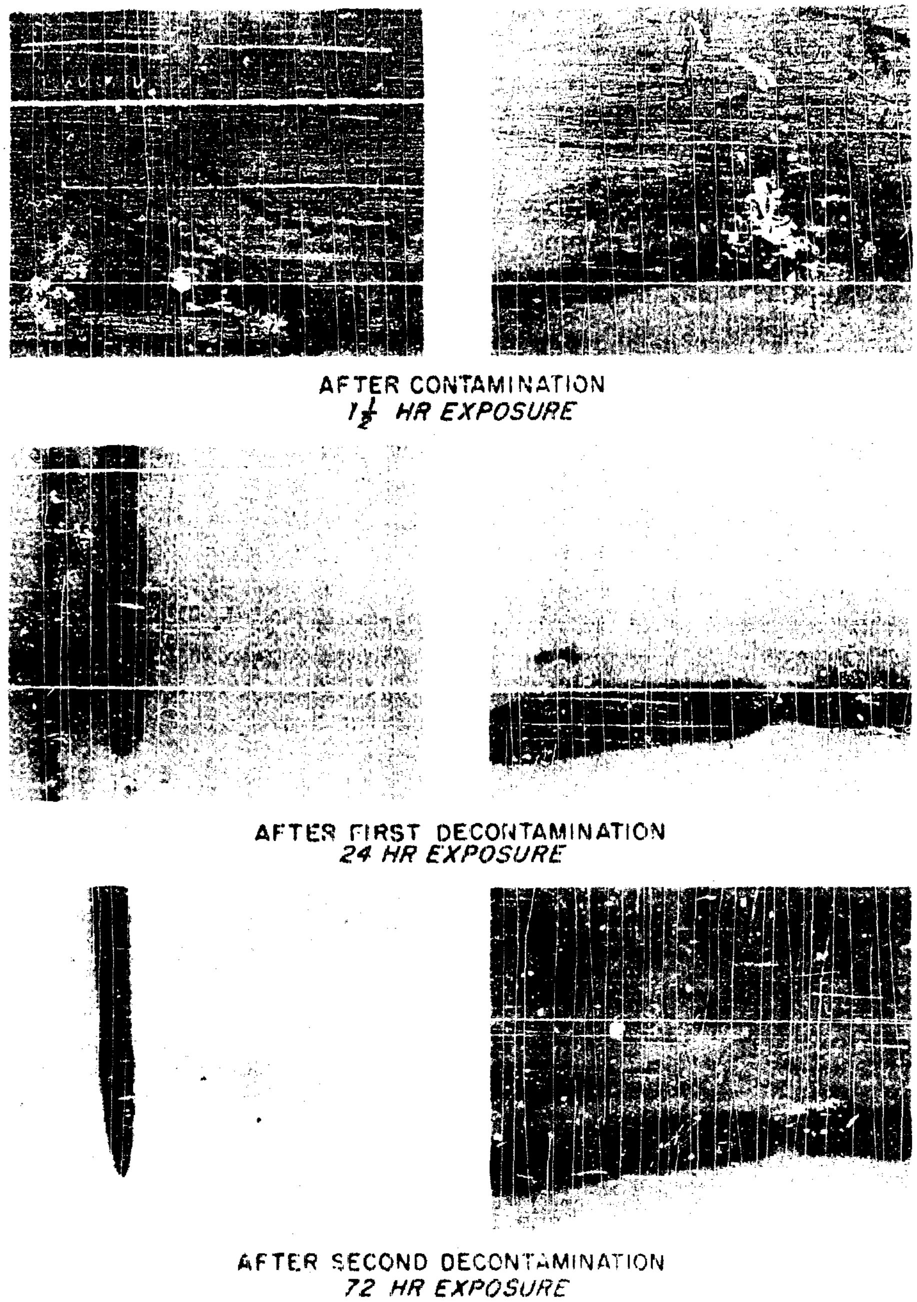

Fig. 3 Radioautographs of Representative Oak Samples: Right Column, With-Grain Sample 28 and Left Column, Cross-Grain Sample 30

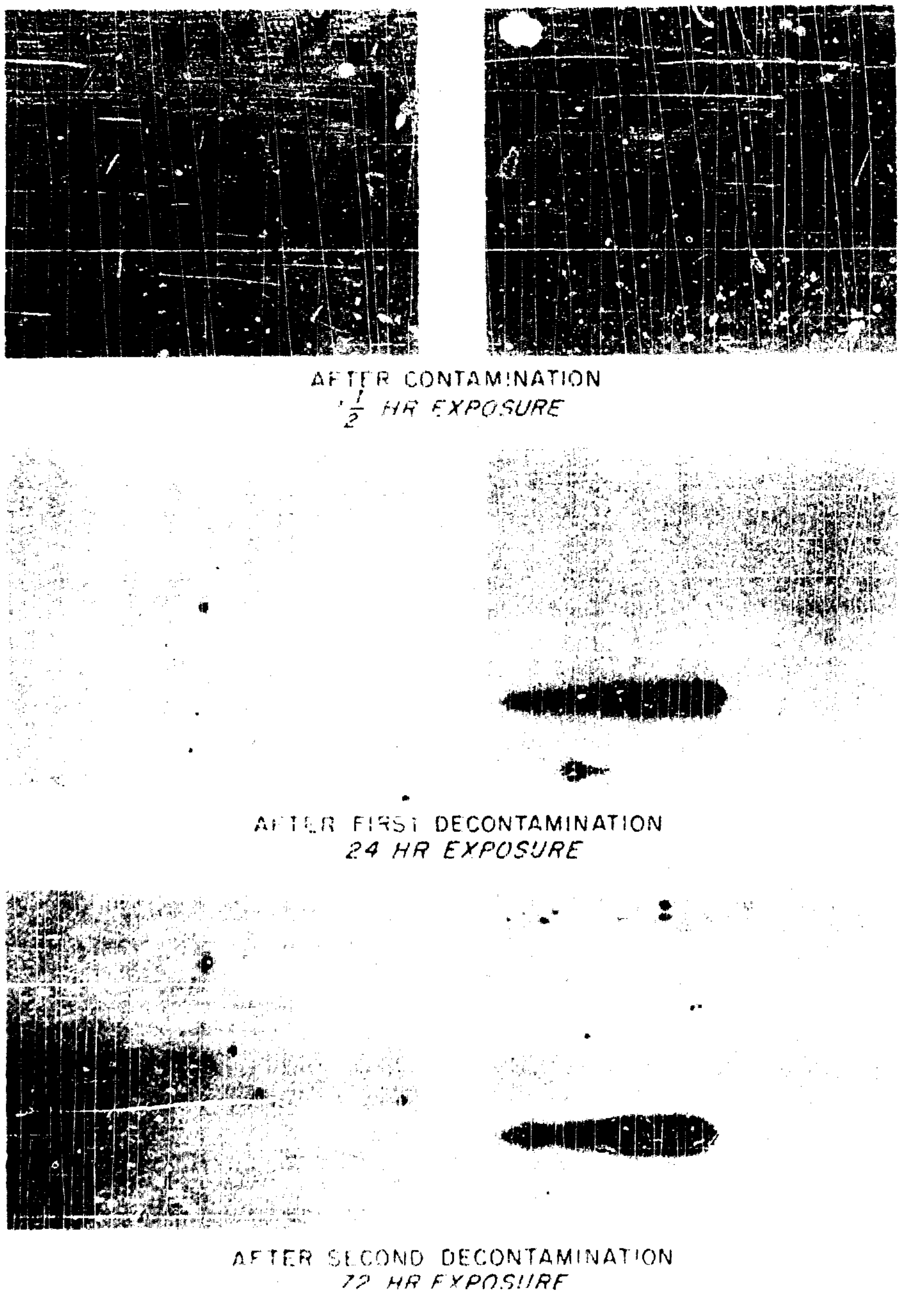

Fig. 4 Radioautographs of Representative Teak Samples; **Right** Column, With-Grain Sample 34 and Left Column, Cross-Grain Sample 38

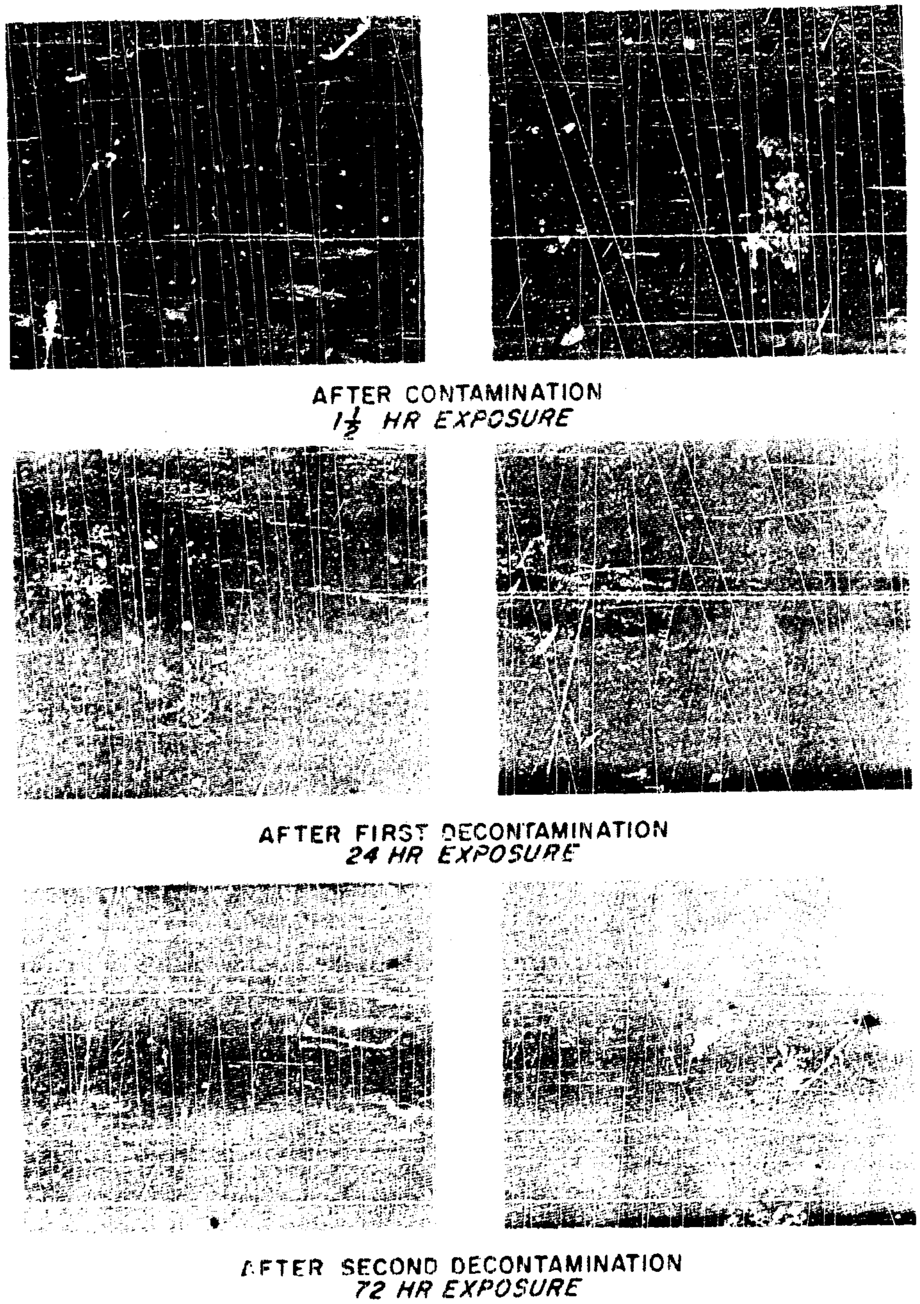

Fig. 5 Radioautographs of Representative Fir Samples; Right Column, With-Grain Sample 40 and Left Column, Cross-Grain Sample 42

surface of Sample 622-21 was not completely decontaminated; Fig. 3 shows the contaminant deposited in a large crack in Sample 622-28; also Fig. 3 shows contamination in the glued joints of Sample 622-30. With few exceptions, the differences in counting rate could be explained by carefully examining the radioautographs.

A lack of sharpness is evident in some of the radioautographs. This was due to lack of intimate cootact between the sample and the X-ray film and to scattering caused by local over-exposure. The lack of intimate film-sample contact was caused primarily by the wood warping, particularly the cross grain samples.

3.3 Surface Removal Measurements

The surface removal data in Table 4 vary fairly consistently with the decontamination factors. In several instances accurate measurements were not obtainable because the wood blocks had warped. As would be expected, the greatest removal was from the pine (0.090 in. in one pass) with fir and teak about 50 per cent lower, and oak slightly lower than these. There was an average increase of 42 per cent surface removal from the first to the second decontamination. This effect has been noticed before and may be attributed to the reduction in moisture content of the surface wood, which makes charring more efficient during the second pass.

3.4 Weight Loss Measurements

The weight loss data, like the surface removal data were quite consistent with the counting data (Table 4). Although there are

Table 4 Surface Removal and Weight Loss Data

Sample(a)	After 1st Decontamination		After 2nd Decontamination				After 3rd Decontamination			
	Weight Loss (g)	Surface Removed (in.)	Weight Loss (g)	Surface Removed (in.)	Total Weight Loss (g)	Total Surface Removed (in.)	Weight Loss (g)	Surface Removed (in.)	Total Weight Loss (g)	Total Surface Removed (in.)
622-21 Pw	9.7	.027	18.0	.062	27.7	.089	9.0	.040	36.7	.129
22	9.3	.020	18.8	.090	28.1	.110	9.1	.040	37.2	.150
23	15.0	.060	15.2	.057	30.2	.117	9.3	.037	39.5	.154
Av Pw	11.4	.036	17.3	.070	28.7	.106	9.1	.039	37.8	.145
24 Px	15.6	.077	11.0	.056	26.6	.133	15.6	.044	42.2	.177
25	15.8	.072	18.5		34.3		14.4	.035	48.7	.107+
26	[illegible].8	.039	22.0		33.8		7.4	.016	40.4	.055+
Av Px	14.1	.063	17.2	.056	31.3	.118+	12.5	.032 (b)	43.8	.150+
27 Ow	12.8	.027	17.7	.022	30.5	.049				
28	11.0	.010	14.2	.022	25.2	.032				
29	9.8	.002	16.2	.025	26.0	.027				
Av Ow	11.2	.013	16.0	.023	27.2	.036				
30 Ox	8.0	.011	16.6	.035	24.6	.046				
31	8.7	.003	15.6	.043	24.3	.046				
32	10.1	.018	8.6	.033	18.7	.051				
Av Ox	8.9	.011	13.6	.037	22.5	.048				
33 Tw	23.2	.048	7.5	.022	30.7	.070				
34	8.1	.018	13.9	.028	22.0	.046				
35	12.4	.028	9.3	.012	21.7	.040				
Av Tw	14.6	.031	10.2	.021	24.8	.052				
36 Tx	11.2	.020	10.1	.019(b)	21.3	.039				
37	3.3	.008	6.2	.025	9.5	.033				
38	13.8	.041	18.5	.030	32.3	.071				
Av Tx	9.4	.023	11.6	.025	21.0	.048				
39 Fw	9.1	.026	15.8	.040	24.9	.066				
40	4.8	.020	14.5	.040	19.3	.060				
41	5.4	.030	12.4	.021(b)	17.8	.051				
Av Fw	6.4	.025	14.2	.034	20.5	.059				
42 Fx	0.9	.022	8.9	.020(b)	9.8	.042				
43	0.1	.040	9.4	.010(b)	9.5	.050				
44	1.5	.030	5.9	.007(b)	7.4	.037				
Av Fx	0.8	.031	8.1	.012	8.9	.043				
Total Av.	9.6	.029	13.6	.035	23.1	.064	10.8	.036	40.8	.148

(a) Letter w or x after the initials designating the woods identifies respectively with-grain and cross-grain samples. (b) Samples warped, measurement questionable.

some individual variances, the general trend indicates that the reduction in contamination level was large where there was a large loss in weight. The hygroscopic nature of dried or charred wood affected the accuracy of the weight measurements. If the samples were not weighed immediately after decontamination or drying, the weight would increase with time. Because of these and other difficulties encountered in accurately weighing fairly large samples, it was concluded that weight loss was not an accurate measurement of the amount of material removed from wood surfaces during decontamination. This criticism would probably apply to other porous materials which tend to regulate their moisture contents according to that of the ambient air.

3.5 Decontamination

This series of experiments disclosed that flame decontamination is a feasible method of decontaminating various types of bare wood. In general, it may be stated that the amount of effort (number of passes) necessary to remove all of the contamination from a given type of wood will be a function of the depth of penetration of the contaminant. If it is known, for example, that the maximum contaminant penetration into a teak deck is 1/16 in., and that the average amount of surface removed per pass with the Flaminator is 1/40 in., then two, possibly three, passes will be required to remove all of the contamination. On the other hand, if the contaminant has penetrated only 1/64 in., one pass will be sufficient.

As would be expected, the white pine was the most difficult of the woods to decontaminate, probably because the contaminant penetrated to a greater depth. For the with-grain pine, three passes, removing a total of over 0.150 in., was required to reduce the contamination level to less than 1 per cent remaining (excluding 622-21 Pw). Even though the surface removal was about the same with the cross-grain pine, three passes removed all but 4 per cent of the remaining contamination. With a few exceptions, in decontaminating the other woods, only two passes and about 0.045 in. surface removal were required to reduce the contamination level to less than 1 per cent remaining. The exceptions were those samples which had deep cracks or open joints that still retained some deeply penetrated contamination. While it would have required considerable additional effort to remove all the contamination from these cracks and joints, their contribution to a large gamma field would be very small, and probably could be safely ignored in most cases.

One of the original objectives of this experiment was to determine the relative decontamination effectiveness of wire brushing with the Flaminator either with-grain or cross-grain. The various data indicate that the results vary with the type of wood. For example, pine was more effectively decontaminated by with-grain; however, more surface and weight was removed cross-grain; oak was more easily decontaminated cross-grain; teak, cross-grain; and fir, with-grain. The action of the wire brush on fir, with-grain, and to some extent on pine, with-grain, was unique in that there was a great deal of undercutting of the soft grains in the wood (see Fig. 6). The undercutting was not apparent on the teak samples and only slightly evident on the oak ones. This grooving is an advantage in decontamination, since the contaminant probably penetrates the softer grains to a greater depth than the hard grains.

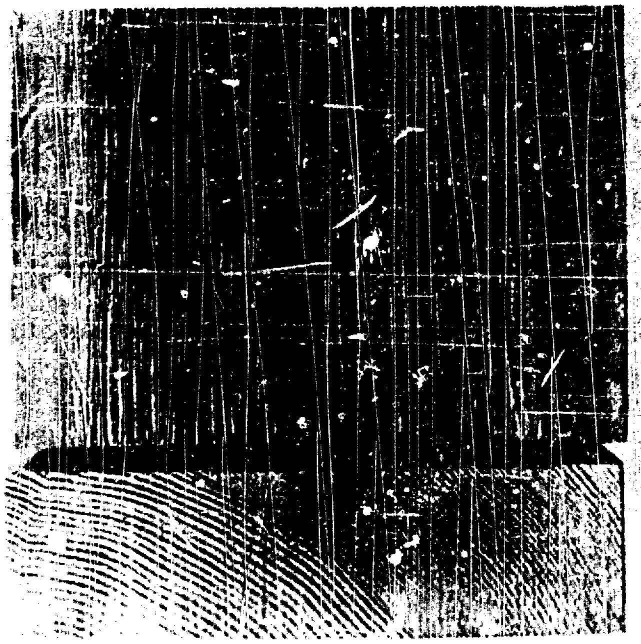

Fig. 6 Undercutting action of the wire brush on a fir sample.

3.6 Flaminator Characteristics

In this series of tests the flame treatment was done separately from the surface removal operation. Although the laboratory model Flaminator can do both these operations at once, they were done separately for better control and observation in these tests. As with the earlier tests*, the vacuum cleaner picked up the material removed by the wire brush, and collected the hot burner gases and filtered them through a Chemical Corps filter. While it was desirable to collect the gases because of the possibility of a slight airborne hazard, this use of a conventional vacuum cleaner with a sawdust-filled cloth bag constituted a fire hazard. However, no fires were started in the vacuum cleaner during these tests.

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* See Footnote on Page 1.

The wire brush was another source of difficulty in operating the Flaminator. The arrangement during the tests was to maintain a load (approx. 25 lb.) on the brush by adjusting the height of the rear wheel. This worked very well on perfectly flat samples, but the warped samples caused the brush to "cut" unevenly, i.e., to dig into the high areas and entirely miss the low areas. On these warped samples it was necessary for the Flaminator operator to manually control the "cutting" action of the wire brush (via the brush load) and make several passes over the sample to remove all of the charred surface material.

The Flaminator, in general, worked well. The choice of an oxy-propane flame was advantageous, since it provided an easily lighted, high temperature flame which could be used safely without back firing even with nozzle temperatures far above the safe limit for oxy-acetylene burners. This high nozzle temperature partly resulted from enclosing the flame within a hood, so that all the burner gases which were slightly contaminated could be collected.

4. Conclusions

Soft woods like pine absorbed more ionic contamination than harder or more dense woods, and the contamination penetrated more deeply.

Contamination adhering to the edges of thick samples emitted sufficient radiation to give erroneous decontamination results, until the edge contamination was properly shielded from the counter probe.

Radicautographing each step of the contamination and decontamination process aided greatly in evaluating the experimental results. This technique disclosed such irregularities as edge contamination, and crack and joint contamination which were not removed during normal decontamination.

Accurate measurements of the amount of material removed from the decontaminated wood was difficult. Surface removal measurements (reduction in thickness) were complicated by the irregular combed surface of wire brushed samples. Weight changes were not too reliable because of the inherent nature of wood to adjust its moisture content according to that of the ambient air.

Ease of decontaminating bare wood was a function of the depth of penetration of the contaminant. Of the woods tested, pine was the most difficult to decontaminate.

Flame cleaning, with a wire brush, surface - removal tool removed approximately 0.050 in. per pass from pine and 0.025 in. per pass from oak, teak and fir under the conditions of this test.

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